CONTRIBUTIONS FOR A SYSTEMATIC CATALOGUE OF THE AQUATIC SHELLS OF TASMANIA.

By W. F. Petterd.

Part I.

I purpose in a series of papers revising the somewhat large amount of work that has already been done, recording omissions, and describing newly discovered species and varieties of the fresh water shell-bearing mollusca of this island, preparatory to the compilation of a systematic catalogue in which the groups will be defined, the specific characteristics explained and geographical distribution recorded. Such a catalogue carefully criticised with the necessary bibliography will, I think, supply a desideratum much required by the general collector and may also be of service to the more philosophical student.

All workers in this special field of zoology well know the extreme difficulty to be surmounted as to specific limitation from the great variability of aquatic testacea in all parts of the world. This is caused by a very large number of local influences retarding, or otherwise, the development of the more pronounced and important specific characteristics, so that many supposed distinct species collected from special localities prove not to be so when a large series are examined from many habitats; on the other hand, it sometimes occurs that what are considered simple varieties prove to be specifically distinct when carefully compared with typical examples. The most apparent influences are the greater or less rapidity of the streams in which they live, the chemical effect of the mineralogical formation through which they flow, the variety and more or less abundance of the requisite food-plants, combined with the varying altitude of the habitat; all are important factors in producing modification of the shell covering, but fortunately the animal is far less susceptible to variation. It is now a well established truth that its examination is an almost infallible guide for the determination of species, so that it becomes absolutely necessary to undertake an extensive series of comparisons from as many localities as are accessible before a systematic catalogue can be worked out so that it may be of real scientific value and service.

The primary reason for my recent investigations was to endeavour to discover the correct genus in the system of

classification in which to place the many species of minute paludinoidal aquatic shells, so abundant in all our streams and pools, and with this end in view I have selected the most abundant, widely dispersed, and characteristic form for special examination.. Moreover, it was the first species to be recorded, having been discovered in our streams by those illustrious early French naturalists, Quoy and Gaimard. The older conchological writers were satisfied in placing those then known in that, to our modern eyes, mixed genus *Paludina* which then included a heterogeneous assortment of small shells of a conical form without reference to their habitats being fluviatile or marine. More recent scientists have annexed them to a numerous variety of genera of more or less stable definition; among others the following generical terms have been applied to many of our indigenous species:—*Paludina, Bythinia, Bythinella, Paludestrina,* and *Hydrobia,* but unfortunately almost all our writers have simply devoted their attention to the outline of the shell and structure of the operculum, few, if any, devoting the amount of attention to the malacological characters that the more modern and elaborate system of classification demands. All scientific conchologists agree that the inhabitant of the shell requires thorough examination before the generical position can be with certainty decided; more especially in reference to the lingual membrane and the form and arrangement of the denticles thereon. This mixed and varied arrangement can well be overlooked when we consider the lack of information at the disposal of classifiers, for almost the total of the diagnosis that they could give had to be obtained from the extremely limited number of examples contained in the cabinets of the general collector and the cases of museums. My investigations have led me to place, without any hesitation, our most prominent species in a genus quite new for Tasmania or even Australia, it is that of *Potamopyrgus,* established by Dr. Stimpson in the "American Journal of Conchology," Vol. I., 1865, for the analogous minute aquatic pulmonate mollusca of New Zealand, having conically ovate shells, horny operculum, animal with long slender tentacles and peculiar formula in the arrangement of the denticles on the membrane. The species have hitherto been supposed to be peculiar to the molluscan province of New Zealand. The most characteristic form of this island (*Paludina nigra, Quoy and Gaimard* Voyage Astrolabe, III., p. 174.) agrees with all the essential characters of Dr. Stimpson's diagnosis of his genus, both as regards outline of shell and animal as well as in the arrangement of the dental formula. Professor Hutton has very concisely worked out the various forms peculiar to New Zealand (Trans. New Zealand Institute, 1882), and that learned conchologist therein refers to the general similarity of

Potamopyrgus antipodum (the *Amnicola antipodum of Grey, vide* Dieffenbach's New Zealand, 1843), a form of extreme variability in the outline of its shell to the species described by Quoy and Gaimard, so abundant in almost all the sluggish streams of this island.

I also describe several apparently new species that in all probability belong to the same group, but in most instances the opportunity of a careful examination of the animals has not occurred.

Several species I purpose placing in a new sub-genus, and add one or two others, but with no little hesitation, as in most cases the animals have not been examined.

In the genus *Limnœa* a great amount of confusion has been caused, principally by the well known general variability of all the members of the family, and also from the fact that an European form—the *L. peregra*—has been acclimatised, the young immature shells of which have been mistaken for an indigenous species, and also that one observer has confused it with an undoubted native kind.

I think I shall be able to show that we have at least four indigenous species, one of which at least has been placed in a genus that has been established upon malacological characters. I have known for many years that the species referred to—*L. Launcestonensis—Tenison-Woods*, was really an *Amphipeplea*, with the lobed mantle extending over a portion of the shell. Professor Ralph Tate has described a species under the name of *A. papyracea* (Trans. Royal Soc. of South Australia, 1880) from Penola, S. Australia, and more recently recognised several examples in a collection of aquatic shells, forwarded him by Mr. R. M. Johnston, mostly obtained from the Huon River (see "On the community of species of acquatic pulmonate snails between Australia and Tasmania." Pro. Royal Soc. Tasmania, 1884, pages 214-17.) Upon careful examination of a very numerous series of examples from many localities, I feel confidant that this species with the *L. Launcestonensis* and *L. Huonensis* of *Tenison-Woods*, are simply variations of one common form, apparently well dispersed over this island. The shells show a limited variation within certain well-defined limits, but the animal is invariably constant. This at once sets at rest the idea that one or other of the above-mentioned forms was identical, or a variation of the introduced *Limnœa peregra* of Europe.

The three new species of true *Limnœa* were obtained in localities that preclude the supposition of having been introduced, and their form totally separates them from their congeners already known to exist here, or in any part of Australasia. They show considerable specific difference in both outline of shell and form of animal; in habit also they are wide apart, two being confined to pure limped streams,

and the other lives on the surface of mud, within the influence of the tide.

In the *Physæ* a large amount of work remains to be done, so as to arrange the species with satisfaction, and no doubt many of the forms described as distinct species, will require reduction. Their investigation and determination has been difficult wherever undertaken. In the genus *Planorbis* there has also been some little confusion, for I find upon the examination of typical specimens, that the *P. meridionalis, Br.*, is very distinct from the shell named by the Rev. Tenison-Woods, as *P. Tasmanica*, which name was withdrawn by that learned gentleman in favour of the former, under the supposition that they were identical. An examination of the drawings—taken from undoubted typical examples—will at once show the great amount of difference in form, and a careful investigation of many hundreds of specimens has not resulted in the finding of any intermediate variations, so that I consider that both species should be retained. That described by Mr. R. M. Johnston under the name of *P. Atkinsoni*, I find to differ very materially from either, although it clearly shows a nearer approach to the *P. Tasmanica*, than to *P. meridionalis*. Another, but smaller form, will be given in the catalogue, it is the *P. Scottiana*, a shell of very constant character, without any likeness to the three species mentioned. In the *Ancylinæ* but little remains to be done, although I have examples from the Liffey and Scamander rivers that differ very much from described species. We have two remarkably large species, one of which, the *Ancylus Cummingianus, Bor.*, forms the type of the genus *Cummingia*, established by Clessen, for its reception; this was proposed many years ago by Hanley. The animal of this shell, as well as that of its congener, *A. Irvinæ, mihi*, will repay examination; a distinguished American conchologist thinks they will show a wide departure from that of the typical *Ancylinæ*. Two additional species of *Assiminea* have been recently added to our fauna, one an Australian form, and the other, so far as at present known, restricted to a single locality on the North Coast. The *Rissoa mariæ* of Tenison-Woods presents the form of *Hydrobia*, and Professor Tate is of opinion that it would be better placed in that genus, in which I think it will be also necessary to place the *Rissoa Brazieri, T. Woods*; the habit of the latter is much the same as typical *Hydrobiæ*, but an investigation of the animal in both cases would be of some importance, and moreover settle the point. In the genera *Pisidium* and *Sphærium* some little difficulty will be encountered, and it may be necessary to add a new species to each. The *S. Tasmanicum* will require careful comparison with examples of British species, as it may prove to be an acclimatised form.

I have thought it well to reproduce the original descriptions of several obscure Tasmanian aquatic shells that were published in the proceedings of the Vienna Society of Zoology and Botany many years ago from specimens sent to Europe by the late Mr. Ronald Gunn, and also of one collected in the island by Professor Braun. These extracts I consider of very great value and interest, as they no doubt will have an important influence upon the nomenclature of the subject and furthermore open quite a new and unexpected field for careful investigation—later on I will endeavour to identify the species described by the various authors. I may state that the *Ampullaria Tasmaniæ*, *Le Guillon* (Revue Zool. page 105, 1842) is no doubt the shell now known as belonging to the more modern genus *Amphibola*, which is generally considered as more fittingly placed in the marine molluscan fauna. I have to thank Mr. John Brazier, F.L.S., for the arduous task of supplying me with exact copies of the descriptions taken from the extremely rare scientific publications in which they appear, and to Mr. Thureau, F.G.S., I am indebted for the kind and cheerful manner in which he undertook to give me literal translations.

So far as investigation has gone very few of our species have been found to be identical with those known to exist in the mainland of Australia, although a very large amount of practical work has been done since the publication of the catalogue of the fresh water shells of this island by the Rev. Tenison-Woods (Proc. Royal Soc. Tas., 1875); more recently we have had the useful reference summary of Professor Ralph Tate and Mr. John Brazier, entitled "Check List of the Fresh-water Shells of Australia" (Pro. Linnean Society of N.S.W., 1881), the elaborate and beautifully illustrated catalogue by Mr. Edgar A. Smith of the British Museum ("On the Fresh-water Shells of Australia," Journal of the Linnean Society, London, 1882), and many valuable and important papers by several well-known specialists all materially enhancing our knowledge of this comparatively neglected department of natural history. In Australia the cosmopolitan genus *Physa* is very largely represented, for of this group above 50 species have been recorded of which number only two or three have the faices of our insular forms. *Limnæa* has 16 species, one of which is certainly, and another doubtfully, identical with forms common here. *Planorbis* is represented by but six kinds, all different from those known to exist in our streams. The genus *Unio* has about 17 species to our peculiar one which is restricted in habitat to northern rivers. In the *Bithynia*-group only six species are quoted; here we have a much larger number. Only one form of *Ancylus* has been discovered to our four—the two giants of the genus have no congeners in the mainland. The northern form of

Gundlachia has been discovered by Professor Tate in a small stream near Adelaide, South Australia.

The following genera having representatives in Australia are not known here, viz., *Neritina*, *Melania*, *Corbicula*, *Segmentina and Vivipara*, the first two are more characteristic of tropical than temperate climates. Some few of our aquatic mollusca have a resemblance to those of New Zealand, notably the *Unio*, the species of *Potamopyrgus*, and one of the *Lymnœa*, the *L. ampulla Hutton*, very closely approaches a small species that I have named *L. Gunnii*. The wide difference in the fluviatile and terrestrial—only about nine species of our land shells extend in range to the mainland—molluscan fauna of the island from that of Australia, proves that they have been separated for a considerable geological time, although, no doubt, the severance occurred during the earlier tertiary period.

It will be found that the fresh-water shells of Tasmania present a peculiar series of forms that are well worthy of careful study; and no doubt as the examination of the streams in the more remote portion of the island is undertaken, many additional species will be brought to light and the range of many found to be more extended than is at present known.

Amphipeplea Launcestonensis. *Tenison-Woods.*

Plate II. Fig. 11.

Limnœa Launcestonensis. T. Woods, Pro. Royal Soc. Tas., 1876.

Limnœa Huonensis. T. Woods, op. cit.

Habitat—River Huon, Hamilton, River Ouse (Dyer), River Glenelg, South Australia (Tate), many places about Launceston, St. Leonard's, Carrick, Deloraine, Circular Head, Rivers Mersey, Forth, Leven and Piper, Flinders' Island, King's Island, Cape Barren Island.

A careful examination of the types of the two species erected by the Rev. Tension-Woods, preserved in the Hobart Museum, and a comparison with many hundreds of examples collected at numerous localities, in all stages of growth fully prove that they are but specimens in different stages of development. It is generally to be found crawling on the margins and the bottoms of quiet secluded pools, and is not often met with in running streams.

It is very different to the introduced *Limnæa peregra* of Europe (Plate III. Fig. 13), which I have not met with in the northern portion of the island.

var. a. PAPYRACEA. Tate. Trans. Royal Soc. S.A., 1880.

Plate II. Fig. 12.

Habitat — Penola, Adelaide, and Kangaroo Island, South Australia (Tate); Merrigum, Victoria (Bailey, apud. Tate); Ouse River (Dyer), Mowbery, Waverley, St. Leonard's, and many other places near Launceston, Fingal, St. Mary's, Huon River, etc.

I am of opinion that this is but a variety of the above; they are found living together in the same pools about Launceston. I cannot see any difference in the animals. At Penola, S.A., Professor Tate found numerous dead shells in the bed of a dried up marsh; here they may be often obtained under similar circumstances.

LIMNŒA SUBAQUATILIS. *Tate.*

Limnœa subaquatilis. Tate. Trans. Roy. Soc. S. Australia, p. 103, t. 4 fig. 6.

Habitat — "Among paludinal herbage growing on the marshy margins of the River Torrens at Adelaide, S. Australia" (Tate).

var. a. NEGLECTA.

Plate II. Fig. 13,

Shell, thin, pale greenish horn colour, broadly ovate, ventricose, with irregular longitudinal lines of growth; spire short, suture very much impressed; *aperture* ovate, more than half the length of the shell; columellar fold indistinct, joined to the labrum by a very thin shining callosity.

Length, 7. *Breadth*, 5 *mill.*

Animal (Plate IV. Figs. 1 and 2), short and broad, not showing beyond the shell behind, yellow brown colour, darker above with specks of darker shade and irregular flakes of a lighter colour; foot broad and pointed behind; tentacles short and blunt; eyes very distinct, distant from the margin.

Habitat—Found living on damp moss and mud in the Ti-tree swamp, near Launceston.

This interesting shell I have made but a variety of Professor Tate's species with considerable doubt, but the similarity of the figures and somewhat peculiar habitat of both has restrained from erecting it into a distinct species until the animal of the type has been examined. The animal does not glide as is usual with the species of the genus, but moves with a peculiar jerky motion.

LIMNŒA GUNNII. *n. sp.*

Plate II. Fig. 10.

Shell thin, fragile, shining, yellowish horn colour, ovate, marked with very fine longitudinal lines of growth; *whorls*

4½, rounded with a moderate satural impression; spire very short and small, pointed, acute; *aperture* ovate, columellar arched and a little reflexed near the umbilical region; fold small and inconspicuous; labrum very thin, acute.

Length, 7. *Breadth*, 5½ *mill.*

Animal, pale bluish white; head very broad; tentacles short, flattened, of a pale milky white; muzzle expanded.

Plate III. Fig. 9 and 12.

Habitat—South Esk River, near Launceston.

This specie differs very much in form from its nearest congener *L. subaquatilis var. neglecta*, both in the outline of the shell and animal. It lives in clear, gently flowing water, attached to the submerged rocks about which it smoothly glides without any of the jerky motion so characteristic of *neglecta*.

The animal at once separates it from *Amphipeplea Launcestonensis*, and from the introduced *L. peregra*, it may be known by its smaller size, form and texture of the shell. The *L. ampulla*, Hutton, from Hasterton, New Zealand, is nearly the same in size and form, but quite specifically distinct.

Limnœa lutosa. *n. sp.*

Limnœa Tasmanica mihi. M.S.

Plate II. Fig. 13.

Shell, narrowly ovate, pointed above, brown-horn, dull; *Whorls* 5, flatly convex, coarsely marked with lines of growth, spire turreted, apex acute; body whorl elongated; aperture ovately pyriform about two-thirds of the total length of the shell; *Columella* almost straight, flattish and reflexed, with a thick shining, arched deposit of callus which forms a false but minute umbilicus.

Animal?

Length, 12. *Breadth*, 6 *mill.*

Habitat—Brighton, River Jordan (*Dyer*).

A shell with much the appearance of *L. Victoriæ*, from Barnsdale, Victoria, but more acute in form, and almost subperforate. From the other Tasmanian species it is widely different. I have several examples in my collection and all are constant in form.

Planorbis meridionalis *Brazier.*

Plate I. Figs. 4, 5, and 6.

Planorbis meridionalis, Brazier. Pro. Linn. Soc., N.S. Wales. P 20, 1875.

Planorbis cathcarti mihi. M.S.

Habitat—Upper Ouse River (*Masters*). Great Lake (*Irvine*).

This species was first discovered by Mr. George Masters, of the Sydney Museum, in 1864. It is the largest species found here, and the least understood. The three type specimens, from one of which the drawings are taken, were lately sent me for comparison, by Mr. J. Brazier, and I find that what has been generally taken for *meridionalis* by conchologists here, is not in reality so, and that the form described by the Rev. Tenison-Woods, under the name of *P. Tasmanicus*, is quite another kind. This species may be known by its comparatively large size, sharply carinated periphery and depressed aperture. I have not seen this shell from any locality but those given. It has no representative in Australia.

I am informed by Mr. Brazier that the *Planorbis Australianus, Martens,* (Paetel, Cat. der Conch, 1873), is simply a catalogue name, the shell never having been described.

PLANORBIS TASMANICUS. *Tenison-Woods.*

Plate II. Figs. 8 and 9.

Planorbis Tasmanicus. Tenison-Woods. Pro. Roy. Soc. Tasmania, p. 79, 1876.

Habitat—Circular Head, South Esk, and Liffey rivers.

A minute, flatly discoidal shell, which is widely umbilicated above and below, freely showing the whorls on both sides; it is but obscurely angled below the periphery with an ovate aperture. It is totally distinct from the preceding, as the illustrations will clearly show. The Rev. Tenison-Woods withdrew his specific name, as he thought that he had described the same form as Mr. Brazier (Pro. Royal Soc., Tas., 1878).

At Circular Head I have collected it in vast numbers, harbouring among aquatic weeds on the surface of small pools, and in marshes in the same neighbourhood. About Launceston it is not abundant, being only occasionally obtained in the South Esk, here the smaller *P. Scottiana* seems to take its place, The nearest Australian form is *P. Brazieri, Clessen,* from Ipswich, Queensland, but that species is more acutely keeled and even flatter.

PLANORBIS ATKINSONI. *Johnston.*

Plate II. Figs. 6 and 7.

Planorbis Atkinsoni. Johnston. Pro. Roy. Soc. Tasmania, 1878.

Habitat—South Esk River.

Of this shell I have examined a great number of specimens, and I have invariably found it constant in its specific characters. Its acutely keeled periphery, and remarkably swollen and angled aperture, at once separates it not only from our other forms, but also from all the known Australian representatives of the genus. In colour even it differs from the other Tasmanian kinds; for it is always of an extremely pale greenish horn, almost white. It is commonly found attached to the leaves of aquatic plants, sometimes in swiftly running water; at Clynevale it is very plentiful.

Potamopyrgus, Stimpson.

Shell, ovate-conic or oval, imperforate; body whorl more than half the length of the shell; aperture ovate, the outer lip acute; peritreme continuous or discontinuous. *Operculum* horny, subspiral, without any internal process. *Animal* with the foot rather short, slender, tapering and pointed. Eyes on very prominent tubercles. *Dentition.* Median tooth trapezoidal, the inferior margin more or less trilobate. First lateral broad and excavated in the middle, contracted into a long peduncle, the denticles nearly equal. Second lateral pointed at the inner extremity; the shank broad, and thickened on its outer margin. Third, lateral with the inner extremity broad and rounded, constricted at its junction with the very broad shank, which is thickened on its outer margin. Number of transverse rows of teeth, 55 to 69.

Formula of the denticles, $\frac{7 \text{ or } 9}{3 \text{ or } 4 — 3 \text{ or } 4}$; 9 *or* 11; 20 *or* 23; 30 *to* 40.

The formula of the denticles differs widely from that of *Bythnella*, and approaches more nearly those of *Stomatogyrus* and *Amnicola*; but *Potamopyrgus* is readily distinguished from both these genera, by the shape of the third lateral tooth.

The above is the diagnosis of this genus, as given by Professor F. W. Hutton, in his paper on the New Zealand *Hydrobiinæ*; it is a slight modification of Dr. Stimpson's original description that was found necessary on more extended investigation.

The distribution is given in Tryon's "Structural and Systematic Conchology," as New Zealand and Cuba.

Potamopyrgus nigra *Quoy and Gaimard.*

Plate III. Figs. 2 to 8.

Paludina nigra, Quoy and Gaimard. Voy. Astrolabe, iii., p. 174.

Bishynia Legrandi, Tasmanica and unicarinata. Tenison-Woods. Pro. Royal Soc. Tas., 1867.

Trans. New Zealand Institute, 1882.

Paludestrina Legrandiana and Wisemaniana. Brazier. Pro. Zool. Soc. London, p. 678, 1871.

Amnicola Petterdiana. Brazier. Pro Linn. Soc. N.S. Wales. Vol. 1., p 19, 1875. (*Tenison-Woods.*)

Bythinella exigua. Tenison-Woods. Pro. Royal Soc. Tas., 1878.

Animal, with a narrow foot which is expanded in front, opaque, white shaded with very pale bluish-grey. *Tentacles*, long, slender and pointed. Eyes plainly visible, under the lens, at the outer base. *Rostrum*, thick, projecting and wrinkled. The tentacles and rostrum shaded with dark bluish-grey.

Operculum, thin, yellow-horn, paucispiral.

Dentition. The central basal lobe of the median tooth is much produced, the first lateral is very much bent, and has from 12 to 13 small rounded denticles thereon. In the second they are also of the same rounded form but are not continuous.

Formula of denticles, $\frac{9}{3-3}$; 12 to 13 ; 11.

Var. A. LEGRANDIANA. *Brazier.*

Shell, conical, with the last whorl keeled below the suture, and furnished with small, solid, stunted, hair-like spines. Aperture ovate.

Habitat—Widely distributed. Streams and pools near Hobart and Launceston. Huon River, Elizabeth River, River Mersey.

Var. B. UNICARINATA. *Tenison-Woods.*

Shell, conical, thin, last two whorls with one interrupted keel. *Aperture*, ovate.

Habitat—With the last.

Var. C.

Shell, elongately conical, tapering, narrow.

Aperture, narrowly ovate.

Habitat—On stones and mud within the influence of salt water. River Tamar and other places.

The "minute shining ovate scales" referred to by the Rev. Mr. Woods are simply an incrustation of the frustules of *Cocconeis*, a species of *Diatomaceæ*. This specie is extremely variable in form, size and ornamentation ; for these reasons I have taken the plain, unadorned minute blackish shells, so abundant in our streams, as the type of the specie under which, with the three extreme modifications given, the great majority of the examples generally to be obtained may be arranged.

In size, with the relative length of spire and aperture, it varies almost indefinitely, so much so that almost every little stream or pool has its own special variety, so that it is quite

impossible and certainly unnecessary to enumerate all the modifications. In many localities the whorls are more or less sharply carinated, with sometimes the additional ornamentation of a line of interrupted pointed spines, but plain, carinated and spinose specimens are often found living in the same pool. The same peculiarity has been noticed in one or two of the New Zealand forms of the genus.

In clear running streams the shells are often subtranslucent and of a pale yellowish horn colour, but in quiet still water they are usually coated with a thick covering of decaying vegetable matter, generally of a rusty brown colour; often a closely packed mass of *Diatomaceæ* covers not only the shell but also the operculum. In a small variety, collected at Deep Creek near the Duck River, the penultimate whorl is abnormally developed and the aperture constricted; it is possible that some conchologists may consider this and others worthy of enumeration as varieties. Its nearest congener in New Zealand is *P. Antipodum, Gray;* it is also a variable shell, extending in range throughout the whole of that colony; it is also found in brackish as well as fresh water. The teeth agree in form with Dr. Stimpson's diagnosis, but the number of denticles on the laterals present some modification; this I do not think of great importance.

Potamopyrgus Woodsii. *n. sp.*

Plate I. Fig. 12.

Shell, small, turbinately conical, thin, brown-horn colour, covered with a thin epidermis, marked with irregular very fine lines of growth. *Whorls* 5, very convex, suture impressed, spire short, apex obtuse, rounded. Body whorl large, inflated. *Aperture* somewhat large and full, ovate, nearly one-third length of shell. Peristome continuous, inner margin free, forming an indentation behind, labrum thin. *Operculum*, yellowish horn, thin paucispiral, with an internal submarginal elevation. *Animal*, with long tapering tentaculæ and projecting muzzle, coloured dark lead-grey, foot of moderate width, white. *Dentition*, median both with the base broadly and roundly expanded, pointed on either side, first lateral club shaped, but little bent. Second much curved and broad. The third is much rounded above, and the constriction at its junction with the shank is deep, so that it forms a prominent, rounded, and curved tooth.

Formula of denticles, $\frac{9}{4—4}$ 11; 20 to 23. Number of transverse rows, nearly 70.

Length, $3\frac{1}{4}$; *breadth*, $2\frac{1}{4}$ *mill.*

Plate IV. Fig. 3.

Habitat.—South Esk River.

In the First Basin near Launceston this species is in extreme profusion both in swiftly running and almost still water. On the large boulders of diorite it may be seen in countless thousands in company with one or two other small forms. In coloration it is subject to considerable variation, sometimes the edge of the aperture is almost white, and much resembles the tint of the rock to which they adhere. In this locality it appears to take the place of *P. nigra*, a species that is not found with it. The arrangement of the denticles on the radula shows all the essential characteristics of the genus in which I have placed it, and their form differs so very materially from those of the last described, that no doubt can exist as to their specific difference.

Potamopyrgus Smithii. *n. sp.*

Plate I. Fig. 10.

Shell, very minute, subpupiform, brownish horn, glossy, almost smooth. *Whorls*, 5 to 6, very convex, suture much impressed, body-whorl moderate size. *Aperture*, ovate pointed above, straight, peristome continuous, free, labrum thin, not expanded. *Operculum*, thin, horny, pancispiral.

Length 2; *breadth* 1 *mill.*

Habitat—Heazlewood, Arthur, Waratah, and Castray rivers, abundant on stones, etc.

This little species has somewhat the appearance of *Amnicola Simsoniana, Brazier* (Plate II., fig. 5), but differs in its much smaller size and more swollen whorls; it may, however, prove to be an extreme variation. So far it has only been obtained in the western streams of the island, where it no doubt has a wide range. I have named it after Mr. James Smith, the veteran explorer and discoverer of the Mount Bischoff Tin Mine.

Potamopyrgus Brownii. *n. sp.*

Plate III. Fig. 14.

Shell, minute, turbinately conical, thin, greenish brown, dull, covered with a thin epidermis. *Whorls*, 5, rounded, suture deep, spire somewhat short and small, obtuse. *Aperture*, ovate, distinct, labrum thin. *Operculum*, horny, pancispiral.

Length, 2; *breadth*, $1\frac{1}{4}$ *mill.*

Habitat—St. Paul's River, near Avoca (Mr. J. Brown), Scamander and Styx rivers, George's Bay, St. Mary's (Mr. A. Simpson). This shell has no important specific character

except its diminutive size and rounded whorls, in both of which it appears to be very constant. At some future time I hope to be able to describe the animal with the dentition, not only of this, but also of other species that I have named.

Potamopyrgus (?) marginata. *n. sp.*

Plate I. Fig. 9.

Shell, small, elongately conical, thin, almost smooth, whitish horn colour, somewhat glossy. *Whorls*, $5\frac{1}{2}$ to 6, scarcely rounded, margined with a fine line above the sutures, apex very obtuse and mammillated. *Aperture*, small, ovate a little expanded below, peristome continuous, attached to the body-whorl. *Operculum*, horny, thin, pancispiral.

Length, 4; *breadth*, $1\frac{1}{2}$ *mill.*

Habitat—a small trickling stream near the Heazlewood River, which is tributary of the Whyte.

I have no hesitation in describing this, in some respects, remarkable little shell as quite a new form, as will be seen by the figure; it differs widely from all its congeners. The sutural line and mammillate apex are peculiar to it, and it alone. It was collected rather sparingly attached to small stones and decaying leaves in a scarcely noticeable little stream.

Beddomeia. *new sub-genus.*

Shell, globosely conical, thin, umbilicate, or sub-umbilicate. *Spire*, short. *Body-whorl*, inflated. *Aperture*, ovate, columellar margin more or less thickened. *Operculum*, horny, paucispiral. *Animal*, with a somewhat broad foot, tentacles long, slender, and pointed, eyes sessile at outer base of same, muzzle broad and projecting.

Dentition as in *Potamopyrgus*, but the trapezoidal median tooth has quite a different arrangement of the inferior basal row, which consists of two ovate elevations on either side of a curved central tooth

Formula of denticles on median tooth $\frac{7 \text{ or } 9}{2—1—2.}$

This new sub-genus it is necessary to form for the reception of the globosely conical forms of *Potamopyrgus*, which also show the above-mentioned modification of the formula of the denticles on the median tooth.

I have named it in honour of my esteemed friend, Mr. C. E. Beddome, the well known conchologist.

Beddomeia Launcestonensis. *Johnston.*

Plate I. Fig. 2.

Amnicola Launcestonensis, Johnston. Pro. Royal Soc. Tas., 1887. *Animal* with the foot of medium size, opaque white, tentaculæ extremely long and pointed, of a dark lead grey colour, *muzzle* broad, wrinkled and prominent, the same colour as the tentaculæ, but freckled with a darker shade. The *eyes* are distinctly visible when the animal is in motion.

Lingual membrane is somewhat long but narrow, with about 100 close set rows of very minute teeth, the formula of which is as follows:— $\frac{9}{2—1—2}$! 8 ! 18 to 20.

Plate IV. Fig. 4.

The median tooth is much arched, has a deep indentation on the upper margin, and the lower central lobe is not very pronounced. The first lateral has a rounded protuberance on the upper inner margin at its juncture with the peduncle and the denticles are pointedly serrate. The second lateral is curved, angular, and much thickened behind, and has 18 to 20 extremely fine rounded denticles. The third is not nearly so much arched and has also a prominent lump on the inside margin.

Operculum, thin yellowish horn, pancispiral.

Habitat—South Esk River.

Var. A. TUMIDA.

Shell, thin, greenish horn colour, marked with fine lines of growth, perforate. *Aperture*, more regular in outline than in mature typical examples; outer lip thin, not reflexed.

Length, 4; *breadth*, 3 *mill.*

Habitat—The Great Lake.

Var. B. MINIMA.

Shell, very much smaller than type, black, granular on surface, perforate. *Aperture*, contracted above.

Length, $2\frac{1}{2}$; *breadth*, 2 *mill.*

Habitat—In a small stream near Scottsdale.

The typical shell is extremely abundant in many parts of the South Esk; it more especially loves the quiet secluded rock pools on the margins of the swiftly running portions of the stream. About the Cataract near Launceston it is very plentiful, often in company with the form I have named *P. Woodsii*; in the First Basin and higher up the river it is more globose in form and of a paler colour, and thus in many respects approaches the variety collected in the Great Lake. The variety *minima* will require further examination as it is possible that the animal may be different to the type; should such be the case it will be necessary to rank it as a species.

BEDDOMEIA TASMANICA. *Tenison-Woods.*

Plate I. Fig. 11.

Valvata Tasmanica. Tenison-Woods. Pro. Royal Soc. Tas., 1876.

I find upon examination that this interesting little species has not the true *multi-spiral* operculum which constitutes the most important character of the genus *Valvata*; in this shell it is *paucispiral* and it is therefore necessary to place it in another genus. Its only known habitat is a small stream in Gould's Country.

BEDDOMEIA BELLII. *n. sp.*

Plate I. Fig. 7.

Shell small, thin, globosely conical, brown, rather dull. Spire small, apex obtuse. *Whorls* $4\frac{1}{2}$, very convex, suture impressed, marked with lines of growth. *Body-whorl* large, inflated with a peculiar open excavated and sharply margined false umbilicus. *Aperture* ovately expanded almost semi-lunar, peritreme continuous, almost straight, thickened and reflexed at the columellar margin, expanded but not reflexed on the labral edge. *Operculum*, thin, dark horny, paucispiral.

Length, $3\frac{1}{2}$; *breadth*, 3 *mill.*

Habitat.—Small stream near the Heazlewood River. Castray and Waratah rivers.

The unique character of the umbilical opening separates this well-marked species from the many other small forms that inhabit our streams. In shape it is not unlike *B. Hulli*, but its colour, combined with the umbilical opening at once separates it. It is named after Mr. W. G. Bell, one of the pioneer prospectors of the western portion of the island, who moreover, takes a very great interest in all scientific matters.

BEDDOMEIA LODDERÆ. *n. sp.*

Plate III. Fig. 1.

Shell, small, globosely conical, thin, brownish horn, covered with a very thin epidermis. *Whorls*, $4\frac{1}{2}$, flatly convex, the penultimate large, inflated. Spire, somewhat small, acute. *Aperture*, large, broadly ovate; peristome, thin, acute, columellar margin rather thickened, depressed and united to the termination of labrum with a very thin, shining callus deposit. *Operculum*, horny, paucispiral.

Length, 4; *breadth*, 3 *mill.*

Habitat—Creek, upper Castra, River Leven (Miss Lodder), Deep Creek, near the Duck River, North-west Coast (Rev. Mr. Hull).

A plain, variable and widely distributed shell. It is generally covered with a thick tenacious coating of rusty coloured decomposed confervæ.

It appears to be distinct from all other described species, and may be recognised by its inflated form and large aperture.

It is certainly not the immature form of any other species, for I have examined a rather large number from both the localities mentioned.

Beddomeia Hullii. *n. sp.*

Plate I. Fig. 8.

Shell, small, pyramidally conical, subperforate, thin, pale horn, glossy, obsoletely keeled at the periphery. Whorls $4\frac{1}{2}$, moderately convex. *Spire*, short, finely marked with lines of growth. *Aperture*, large, acutely ovate, peristome, thin, continuous, feebly expanded on outer margin. *Operculum*, thin, horny, pancispiral.

Length, 3 ; *breadth*, 2 *mill.*

Habitat—Near the Heazlewood River with *B. Belli* and *P. marginata.*

This is a small pale shell with a closer affinity to *B. Loddercæ, mihi*, than to any other form, but it is no doubt specifically distinct. I have named it honour of the Rev. Mr. Hull, a gentleman much devoted to natural history studies.

Brazieria. *New Genus.*

Shell globosely rounded, imperforate ; *spire* small, body-whorl large ; *aperture* very oblique, effuse ; outer lip acute, inner lip thickened ; *operculum* horny, subspiral. Animal?

Brazieria Tasmanica. *Tenison-Woods.*

Plate I. Fig. 1.

Ampullaria Tasmanica. Tenison-Woods. Pro. Royal Soc. Tas., 1876.

Amnicola Tasmaniæ. Tenison-Woods, Tate and Brazier. Pro. Linnean Soc. N.S.W. Vol. VI., 1881.

Habitat—Abundant upon stones in a small tributary of the Arthur River, west of Mount Bischoff (Mr. James Smith).

When describing this shell the Rev. Tenison-Woods expressed great doubts as to its correct generical position, and only provisionally placed it in the genus *Ampullaria*, of which no Australasian forms have hitherto been discovered.

I have submitted examples to several of the recognised conchological authorities, and all are of opinion that an entirely new genus is absolutely necessary in which to place it. I have very great pleasure in naming the genus after my friend, Mr. John Brazier, F.L.S., of the Australian Museum, Sydney, N.S.W., a gentleman well-known in the scientific world, and one who has done an enormous amount of work in the Zoological field of Australia.

ASSIMINEA BICINCTA. *n. sp.*

Plate II. Fig. 4.

Shell small, conical, thick, brownish horn, banded with dark brown, covered, a thin epidermis; *whorls* 4½, convex, obtusely angular near the base. *Aperture*, ovate, pointed above, bands of colour clearly showing within, columellar with thick shining callus deposit below, thin above at junction of labrum. *Operculum*, dark horny.

Length, 4; *breadth*, 3 *mill.*

Habitat—Mouth of the River Don, North Coast (Rev. Mr. Hull), obtained living on stones and grass within the influence of the tide in company with *Tatea rufilabris*. The bi-coloration of this specie is very constant, which, with its small aperture, constitute its most notable characters; in both respects it differs from the *A. Tasmanica*, of *Tenison-Woods* (plate II., fig. 2), as it is not so large or globose as *A. Australis*, *Tate* (plate III., fig. 10). The last mentioned has been collected by Mr. C. E. Beddome, at Kelso, near the mouth of the River Tamar, on the mud flats.

In the "Check List of the Fresh Water Shells of Australia" the *A. Tasmanica* is given as a synonym of *A. granum*, *Menke* (Moll., Nov. Holl., 1843).

HYDROBIA TURBINATA, *n. sp.*

Plate II. Fig. 3.

Shell small, turbinately elongate, thin, brownish green, often much corroded, subperforate. *Whorls* 6½, very convex, suture deep. *Aperture* small, ovate, continuous, columellar margin a little reflexed, outer lip thin, acute. *Operculum* horny.

Length, 4; *breadth*, 1½ *mill.*

Habitat.—River Styx, near Falmouth, East Coast and George's River (Mr. A. Simpson).

This shell was collected in great abundance at the first locality by Mr. A. Simpson; it was living in almost salt water ith true marine species. I have placed it in he genus

Hydrobia, because Tryon retains it for small turbinately elongate shells inhabiting brackish water. The animal is thus described: "Rostrum rather long, tentacles somewhat tapering, but blunt at extremity, foot somewhat pointed behind." I have not had an opportunity of examining the arrangement of the teeth in the radular. Many of the examples from the River Styx have *Serpulæ*, and marine *Polyzoa* attached to them, the corrosion often extends to the body-whorl.

Tatea rufilabris. *A. Adams.*

Plate II. Fig. 1.

Diala rufilabris, A. Adams, Ann. and Mag. N. Hist., 1862.

Hydrobia rufilabris, Smith, pro. Zool. Soc., 1875.

Bythinia Huonensis, Tenison-Woods. Pro. Royal Soc. Tas., 1875.

Tatea Huonensis, Tenison-Woods, op. cit., 1878.

Operculum, thin, brownish, horny, paucispiral, with a vertical submarginal claw.

Habitat.—Port Lincoln, S.A. (Adams), Clarence River, N.S.W. (Brazier), near Melbourne, Victoria (Woods); in Tasmania it has been collected at the following localities:—Huon River (Woods, Legrand, and Beddome), opposite Risdon near Hobart (Simpson), George's Bay (Simpson), River Don Heads (Hull), Rivers Leven and Forth (Miss Lodder). In Tidal Creek at the head of North-West Bay and obtained living with the dredge in from 5 to 7 fathoms of water, 300 to 400 yards off shore at the same locality (Beddome). I have collected it in many localities, including several of the above; at many favourable places in the Tamar river it is plentiful and near Bridport it lives in great profusion.

The identity of the Rev. Tenison-Wood's shell with that described by Mr. A. Adams was proved by Mr. E. A. Smith (On the fresh-water shells of Australia. The Journal of the Lin. Soc. of London, 1882). The fact of its being obtained alive in from 5 to 7 fathoms of water by Mr. C. E. Beddome is very interesting, the examples did not show any variation of the shell. The figure of Mr. Smith does not represent the ordinary form of the species.

Hydrobia Tasmanica. *V. Martens.*

"Weigmann's Archives for Natural Science, 24. Vol. 1., page 185. Pl. V. Fig. 12, 1858.

Shell, 2½ to 3 mm. long, conical, acute and consisting of 4½ to 5 arched whorls of regularly diminishing sizes; suture moderately deep (angle of tangent about 35 degrees),

proportion of length to width = 5 : 2. The mouth, likewise occupies 2-5ths. of the whole length (with young specimens it stands nearly vertical); the upper angle of the same clings to the preceding whorl and appears rounded off; the columnal rim is bent, and closes wholly the umbilicus (in young examples it does not quite do so). Shell, thin, glistening with lines of growth, brown, like *Helix lucida*, or brown-red, edges of aperture white in colour. Apparently it occupies the central position between *thermalis* and *acuta*, as proved by size and colour, which, however, deviate somewhat. (Spiral cover.)

Discovered by Professor Braun, in large quantities with *Chara macropogon*. A. Br. in Van Diemen's Land."

"*H. Tasmanica. V. Martens.*

Von Frauenfeld, in Trans. of K. K. Zool. and Bot. Soc., page 653. No. 830. Vol. XIV., 1864.

This has been described by V. Martens, in Weigmann's Archives, 24, 1, page 185, illustrated on Table V., fig. 12. The reference to "Spiral cover" appears as certainly remarkable."

Hydrobia cristallina. *Pfr.*

This appears to be one of the earlier described species, and judging from the reference made to it, certainly anterior to the next. In the next portion of my summary of our aquatic shells I hope to be able to supply the full original diagnosis.

Hydrobia Gunnii. *Frauenfeld.*

"Transactions of the K. K. Zoological and Botanical Society, Vienna. Vol. XIII. No. III. and IV., page 1,025, 1863.

In Cumming's collections, marked by Mr. Gunn, as from Van Diemen's Land, this shell is found intermingled with *Hydrobia cristallina Pfr.* and likewise *Amnicola diemense Frfld.*

It is characterised by its beautifully formed mouth, which is almost without traces of any edge. Shell, slender, conical, grayish-brown in colour, semi-transparent, frequently with $5\frac{1}{2}$ turns and confined cicatrix, small opening of mouth, round, with totally free edge which arches or overlaps outwards.

Length, 3 *mm*; *width*, 1·5 *mm.*

(Frauenfield).

H. Gunnii, V. Frf. Transactions of the K. K. Zoological and Botanical Soc., Vol. XV., page 526, 1864.

Distinguished by its equally formed mouth or orifice, the edges of which as standing somewhat apart from the spindular cell sides makes one to remember it as similar to a

Truncatella. It is of a still more slender form, than as shown in the illustrations, which represent some as of a very compressed nature.

Hydrobia Gunnii. V. Frfld, this was already described amongst the number and species of these shells in the Transact. of the K. K. Zool. and Bot. Soc., 1883, page 1,025, also in same Transact., page 612, No. 387, 1864."

Amnicola diemense, Frfld.

"Transact. of the K. K. Zoological and Botanical Society, Vienna, Vol. XIII. No. III. and IV., page, 1,028, 1863.

In Mr. Cummings' collection from Van Diemen's Land, this is represented (as intermingled with Hydra Gunnii, Frfld. and cristallina Pfr.) This shell is acute, conical, brownish in colour, almost non-transparent, 4½ turns or windings, slightly arched, and gradually becoming more so towards lower extremity, last whorl largely developed. The mouth is almost circular, large down to half of the length of the shell, edge somewhat wider, not clinging to whorls; umbilicus distinctly visible and deep.

Length, 2·7 *mm. width*, 1·9 *mm.* There were several specimens much smaller, slender, and obtuse, with smaller orifices, so that it was difficult at first to classify between these extremes, though, at last I discovered a medium by means of which these difficulties were put aside.

Note.—I am not quite certain whether these species could not be more properly designated with *Hydrobia*, Frfld.

Hydrobia cristallina. Pfr.

2. Van Diemen's Land, Mr. Gunn; intermingled as aforesaid with *Hydrobia Gunnii Frfld* and *Amnicola diemense Frfld.* As referred to in the Transact. of the K. K. Zoology and Botanical Society, Vienna. Vol. XIII. No. III. and IV. Page, 1,024. 1863."

Amnicola diemense. V. Frfld.

"Transactions K. K. Zool. and Bot. Soc. Vol XV. Page 529, 1865, pl. x. fig. 2.

At the same place the shell described as A. *floridana V. Frfld.*, I noted that it was not quite sure whether or not these two species were not to be better incorporated with *Hydrobia.* In these cases where the shells are so similar in form, it is often very difficult to decide such a question, and it requires some skill to do so.

In the next following newly discovered species, it appears that the slightly compressed forms, the graduated windings or turns, the more open umbilicus, the larger lower mouth or orifice, decided me to classify same as *Amnicola*, which differs but little from *Hydrobia*, and it doubtless renders this classification as very delicate under the circumstances.

Amnicola diemense V. Frfld. Trans. K. K. Zoo. and Bot. Soc. Vol. XIV. Page, 599. No. 268, 1864, in the preliminary examination of the genera and species of *Hydrobia*, *Amnicola*, &c. See Trans. K. K. Zoo. and Bot. Society, 1863. Page 1,028."

Note.—The plates are missing in the volume of the Vienna Societies Transactions, contained in the library of the Australian Museum, Sydney, N. S. Wales. The Linnean Society of N. S. Wales do not possess a copy for the year 1865.

This species will probably prove to be the *Beddomeia Launcestonensis*, *Johnston*, in which case Von Frauenfeld's name will have to be retained.

Unio Legrandi. *n. sp.*

Unio Moretonicus. Reeve, Woods, Pro. Roy. Soc. Tas., 1876. *Tate and Brazier. "Check list of the Fresh-water Shells of Australia." Pro. Linn. Soc., N.S.W.*, 1881.

Of the widely distributed and extremely variable genus *Unio*, we have but a single representative, the one that is peculiar and so abundant in our northern streams. To this shell tradition has applied the specific term *Moretonicus*, under which name it is given by the Rev. Tenison-Woods in his list of the fresh-water shells of this island (Pro. Roy. Soc. Tas., 1876). How this identification originated or by whom applied I have quite failed to discover, but that it is an error is fully elucidated by Mr. E. A. Smith in his paper on the fresh-water shells of Australia (Pro. Linn. Soc. of London, 1882); there the learned author gives an exhaustive summary of the numerous species occurring on the mainland with their full bibliographical history, and the results of a careful study of the extensive series of examples contained in the collection of the British Museum is fully explained. Under *Unio depressus*, *Lam.*, a species common to the Nepean, Bogan, Brisbane, and Murray rivers, it is stated that "The *U. depressus* of the 'Conchologia Iconica,' fig. 81, is a very distinct species, and approaches certain varieties of *U. ambiguus*, the specimen figured being from Tasmania;" an examination of the figure proves this statement to be correct, although the shell represented is not nearly so elongated as the great majority of the examples that I have collected. The *U. Moretonicus*, Reeve (Con. Icon., fig. 118), is given as a variety of *U. Australis Philippi*, but without any precise locality. The plate illustrates a shell of quite a different outline to any of the many hundreds of Tasmanian specimens that I have carefully examined.

The *U. ambiguus*, *Parreyss*, is from the Balonne, Bogan, and the Onkaparinga rivers, and although in many respects it approaches the species of our streams it is clearly specifically

distinct. All writers upon the subject give special prominence to the general confusion into which the Australian forms of *Unionidæ* have fallen, principally caused by slight variations and immature examples having been described as distinct species; this has been rendered more confusing by erroneous habitats often given, and the now well known incorrectness of many of the localities recorded in the "Conchologia Iconica" has also caused several recent authors to fall into error.

After carefully studying the subject and comparing numerous specimens from almost all parts of Australia with an extensive series collected in our streams, I have come to the conclusion that our form, that has been known to conchologists for so many years, is in reality an undescribed species, so that it is therefore necessary to bestow upon it a specific appellation, in doing which I have embraced the opportunity of recording my obligation to Mr. W. Legrand for my early instruction in the study of shells.

In any case the specific term *Moretonicus*, is a geographical misnomer, and, to my mind, it should be altered if only for that reason. The figure given by Reeve, No. 118, very closely represents a variety of *U. Menziesii, Gray*, of New Zealand, from rapid flowing streams when it is much shorter and thicker than the more typical form. In *U. Legrandi* the teeth are small and the interior is clear bluish white with faint iridescence of pink and green. Its home is the sandy beds of shallow clear running streams, where, as in certain parts of the South Esk and the St. Paul's Rivers, it can be obtained in considerable numbers. As is the case with many species of the genus, the sexes differ in the outline of the shell.

Plate I.

Fig. 1. *Brazieria Tasmanica, Tenison-Woods*, Arthur River.
,, 2. *Beddomeia Launcestonensis, Johnston*, South Esk River.
,, 3. ,, ,, var. *minima*, Scottsdale.
,, 4-5-6. *Planorbis meridionalis, Brazier*, Ouse River.
,, 7. *Beddomeia Belli, mihi*, Heazlewood River.
,, 8. ,, *Hulli, mihi*. ,, ,,
,, 9. *Potamopyrgus marginata, mihi*, near Whyte River.
,, 10. ,, *Smithi, mihi*, Waratah River.
,, 11. *Beddomeia Tasmanica, Tenison-Woods*, Gould's Country.
,, 12. *Potamopyrgus Woodsii, mihi*, South Esk River.

Plate II.

,, 1. *Tatea rufilabris, A. Adams*, River Don.
,, 2. *Assiminea Tasmanica, T. Woods*, Brown's River.
,, 3. *Hydrobia turbinata, mihi*, River Styx.